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(54) **Method and Apparatus for Producing a Modified Plasterboard**

(57) The invention relates to a method and apparatus for the production of plasterboard wherein cardboard sheet material 8 is continuously fed along a predetermined path along which its edges are turned up to form a trough shaped configuration, plaster mash for the core is deposited from device 6 on the cardboard sheet material and spread and levelled thereover, glass fibre sheet material 33 permeable to the plaster mash is continuously applied over the spread and levelled mash and pushed into the plaster mash to be covered thereby and the upturned edges of the cardboard sheet material are cut or trimmed to the level of the plaster mash. Before the plaster mash has set, one or more additional glass fibre sheets may be continuously applied over the plaster mash and pushed therein to and covered thereby, the glass fibre sheets being pushed to different levels within the mash.

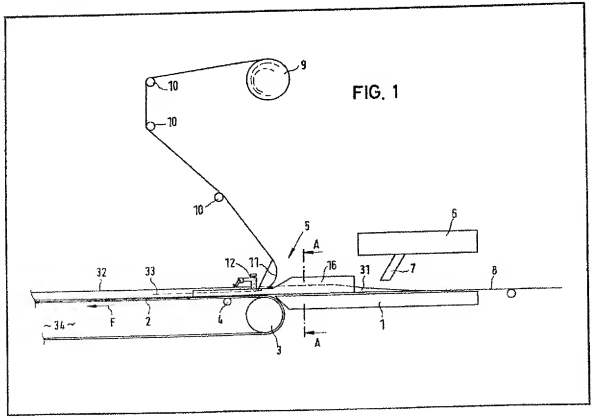

FIG. 1

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FIG. 1

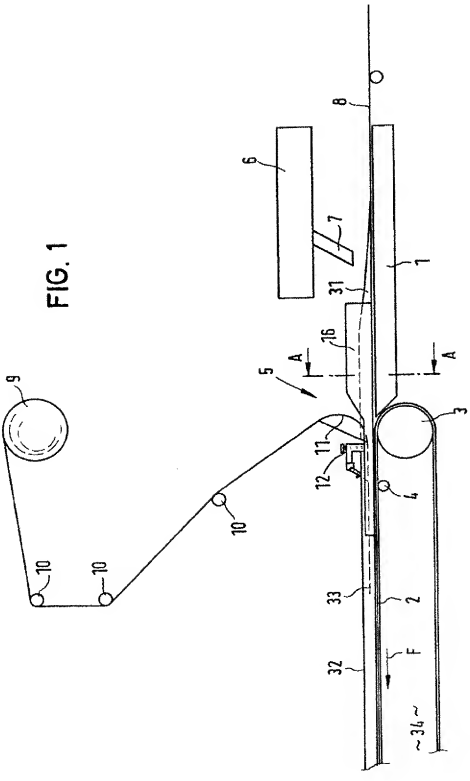


FIG. 2

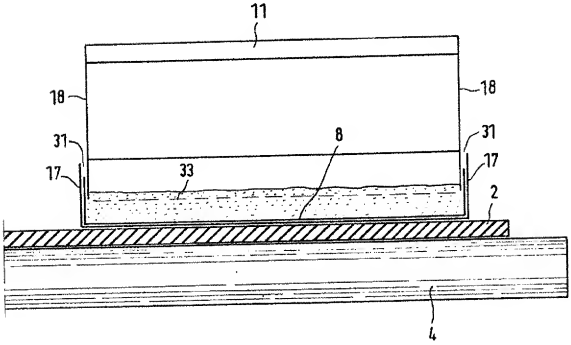


FIG. 3

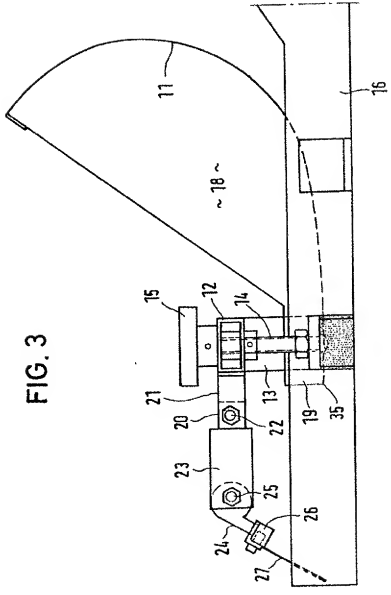
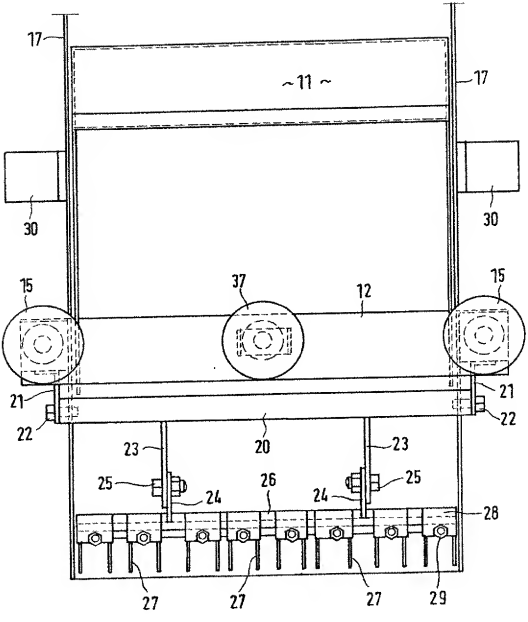


FIG. 4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SPECIFICATION

Method of and Apparatus for Producing a Building Board using Plaster

This invention relates to a method of an apparatus for the production of a building board using plaster.

Building boards incorporating plaster have been known for many decades. The best known board of this type is the cardboard-cased plasterboard consisting essentially of a plaster core surrounded by cardboard. To produce this, a mould is virtually made from so-called "visible side cardboard" on a corresponding belt conveyor by bending up the edges of the cardboard, and into this mould the plaster mash is introduced and shaped to an appropriate thickness, whereupon the rear side cardboard is laid on the exposed face of the layer of plaster mash. Finally the upstanding side edges of the visible side cardboard are folded down over the edges of the rear side cardboard and connected to the latter. Apart from plasterboards of this type, there are also plasterboards without a cardboard casing. In this type of board, the plaster is mixed with fibres, especially with cellulose fibres, which are obtained by suitable processing, for example of old newspapers.

Of the above types of board, the cardboard-cased plasterboard is the most widely known and used. It is distinguished by a number of excellent properties. It does, however, suffer from the disadvantage that it is unsuitable for many applications, for example because of the cardboard casing, which is combustible. For fire protective purposes therefore, a board similar to the cardboard-cased plasterboard with an incombustible casing would be particularly advantageous. A further disadvantage is that the strength, particularly at the surface zones, could be higher than that attainable with the cardboard employed.

It is also known that the cardboard may be replaced by another material, for example by a non-woven glass fibre or a woven glass fibre fabric. In this construction, there is simply a substitution of material, in that a band-shaped material of glass fibres is used instead of cardboard of cellulose fibres.

It has also been proposed that a layer or weave of glass fibres may be applied onto the side of the cardboard facing the plasterboard and then this composite material may be bonded to the core.

Particular advantages are, however, not obtained by this method or this form of construction, because the glass fibre material lies on the surface and the bond to the plaster is not good.

It is an object of the present invention to provide a method of an apparatus for producing a plasterboard which is strengthened and which uses less combustible cardboard facing.

According to one aspect of the present invention, there is provided a method of making a building board using plaster and cardboard characterised in that from a continuously supplied cardboard sheet, a trough is formed by bending the edges upwards to form upstanding edge portions and into this trough plaster mash is introduced, is formed to the desired thickness and at least one glass fibre sheet permeable to the plaster mash is continuously supplied to its free plaster surface and is pressed into the plaster mash in such a way that the glass fibre sheet is completely covered with the plaster mash, and the upstanding edge portions of the cardboards sheet are cut off in the plane of the surface of the plaster.

The invention also provides a method of making a building board using plaster and cardboard which comprises continuously feeding cardboard sheet material along a pre-determined path from a feed of such material, bending the edges of the cardboard sheet material upwards during its advance along said path to form upstanding edges, depositing plaster mash on the cardboard sheet material as it is advanced along said path, spreading and levelling the deposited plaster mash between said upstanding edges, continuously feeding a glass fibre sheet permeable to the plaster mash from a feed roll thereof over the spread and levelled plaster mash and pushing the glass fibre sheet into and below the level of the plaster mash and trimming the upstanding edges to the level of the plaster mash.

In this manner a plasterboard similar to the known cardboard-face plasterboards is produced which, however, carries a cardboard sheet only on one side, this cardboard sheet covering only the edge face of the board with its edges, whereas the other side has a smooth, clean plaster surface, into which there is embedded a glass fibre sheet which cannot be seen from the outside and which gives to the board the necessary strength and an incombustible surface coating.

The glass fibre sheet or web is preferably woven and may also be a so-called glass fibre facing, and the mesh width can vary from a few tenths of a millimetre to several centimetres. Also the number of the glass fibre filaments in the individual yarns of the weave can vary according to the desired use of the board. It is also possible to supply a number of glass fibre woven sheets successively and continuously and to press them to varying depths into the still fluid plaster mash, so that these sheets are embedded at varying depths in the plaster core. The glass fibre sheet must be permeable to and penetrable by the plaster mash.

To carry out the method of this invention, there is provided an apparatus comprising means for continuously feeding a cardboard sheet material along a predetermined path, means associated with said path and operable to bend the edges of the cardboard sheet material upwards during its advance along said path to form upstanding edges, means for depositing plaster on the cardboard sheet material as it is advanced along said path, means for spreading and levelling the deposited plaster mash between said upturned

edges, means for continuously feeding a glass fibre sheet permeable to the plaster mash over the spread and levelled plaster mash, means operable to push the glass fibre sheet into and below the level of the plaster mash and means for trimming the upstanding edges to the level of the plaster mash.

The apparatus preferably provides on the surface of a belt conveyor and on a table disposed ahead of the belt conveyor, a forming device for upwardly bending the lateral edges of the cardboard sheet, following upon which in the direction of travel of the belt conveyor a curved guide surface extends longitudinally, over which surface the glass fibre sheet or web is supplied and after which, transversely to the forming device, a height-adjustable rod is detachably mounted, a comb with a large number of teeth being fixed to this rod, the teeth pointing towards the surface of the belt conveyor and making an acute angle with it.

The curved guide surface which extends above and longitudinally of the belt conveyor, serves for feeding the glass fibre sheet and for smoothing this sheet and for calibrating the material of the board, whereas the teeth of the comb following it at a distance serve for pressing the glass fibre sheet into the plaster core.

The individual teeth of the comb can be streamlined in shape, but preferably have a small cross-sectional area and are in contact with the surface of the glass fibre sheet with the smallest possible part of their own surface. The inclination of the teeth to the surface of the belt conveyor is adjustable, as also is their depth of penetration into the plaster mash. The number of teeth will depend basically upon the type of glass fibre sheet. The number should, however, be such that the sheet can be pressed into the plaster mash without bulging up between the teeth. Also, the number of teeth will depend upon the width of the mesh of the woven fabric.

In pursuance of the concept of this invention, a number of such devices for supplying the glass fibre sheet may be arranged one after the other, in such a manner that this sheet is pressed to varying depths into the plaster core. The flowability of the plaster, the quantity of added accelerator or retarder and the speed of the belt conveyor will then of course have to be adjusted accordingly.

One embodiment of the invention will now be described by way of example, reference being made to the accompanying drawings in which:—

Fig. 1 is a diagrammatic side view of an apparatus for carrying out the method of this invention,

Fig. 2 is a cross-section through the apparatus of Fig. 1 taken along the line A—A,

Fig. 3 is a detail of the apparatus of Fig. 1 to a larger scale, for supplying woven glass fibre and for fixing the curved surface to the moulding box, and

Fig. 4 is a plan view of the apparatus of Fig. 3.

Plasterboard according to the present invention is faced only on one main face and the edge faces with cardboard. The other or opposed main face includes a reinforcing, incombustible inlay in the surface region of the plaster core, consisting of a glass fibre sheet which is permeable to the plaster mash used in the manufacture. It is necessary that this glass fibre sheet be worked into the rear exposed surface of the plaster core sufficiently far even the outward facing surface of the glass fibre sheet to be smoothly and completely covered by the plaster mash. When the glass fibre sheet is pressed into the soft, flowable plaster mash, this mash penetrates into and through the glass fibre sheet and levels itself automatically due to its flowable property, so that a smooth, uninterrupted plaster surface is produced which can be further smoothed by a smoothing tool, if required. In order to carry out this method, the glass fibre sheet must be worked into the plaster mash and an appparatus for achieving this is illustrated in the drawings. The apparatus comprises basically a table 1, followed by a belt conveyor 34 which has a certain length and which comprises an endless conveyor belt conducted around two rollers, one of which is driven. One of these rollers 3 is shown in the drawing.

The surface of the upper run 2 of the conveyor belt is in the same plane as the surface of the table 1 and provides a continuation thereof. The upper run 2 of the conveyor belt is supported by a number of rollers, arranged close together, one such roller being indicated at 4. Above the left edge of the table 1 as viewed in Fig. 1 in the region of the start of the belt conveyor, a forming device 5 is shown which is shown in more detail in Figs. 3 and 4. A mixing device 6 for the plaster mash is disposed above the table 1 and delivers plaster mash through a discharge tube 7 onto a cardboard sheet 8 which is supplied from the right as viewed in Fig. 1. This cardboard sheet 8 is drawn from a roll (not shown) and is comparable with "visible side cardboard" sheet, as is used in the production of cardboard-cased plasterboard. Glass fibre sheet 33 is carried on a roll 9 above the apparatus and is supplied by guide and deflector rolls 10 to the forming device 5 and is worked into the flowable plaster mash already delivered on to the cardboard sheet. The forming device 5 is mounted above the belt conveyor and supports equipment disposed laterally of the conveyor belt but omitted from the drawing for the sake of clarity. The forming device 5 has a curved, shaping and guide plate 11 of evolute from which extends transversely above the belt conveyor and is adjustable in distance from the belt conveyor and from the cardboard sheet 8 to spread and level the plaste mash. For this purpose, a rod 12 extends across the upper run 2 of the belt conveyor at a distance from the surface thereof, this rod being secured on each side of the working width of the board to be produced to upright columns 13 and to threaded spindles 14 rotatably journalled therein. These spindles 14 are secured at their lower end to the guide plate 11

and have actuator knobs 15 whereby they may be rotated. A similar spindle and actuator knob 37 is disposed centrally of the rod 12 and is secured to the guide plate 11 and is similarly operable to adjust the thickness of the board. The rod 12 may be a tube, conveniently of rectangular cross-section.

The forming device 5 also includes a plate 16 of channel-section (U-section), possessing a clear internal width equal to that of the building board to be produced. This plate possesses upwardly bent edges 17 which are at a slight lateral distance from lateral boundary surfaces 18, which are welded into the guide plate 11 at its lateral edges. The guide plate thus has a box-like form and is open only at its rear end, which points in the direction of movement of the conveyor. The plate 16, over which the cardboard sheet 8 travels, is continued forwards beyond the forward end 19 of the shaping plate 11, as can be seen from Fig. 3. This rectangular plate 16 also carries, laterally and outside its channel section, the rod 12 to which the shaping plate 11 is adjustably secured.

A further rod 20 is fixed by means of the lateral angles 21 and bolts 22 to the rod 12 and extends above the device 5. The rod 20 carries two arms 23, to which two further arms 24 are pivotally attached by bolts 25 and these further arms 24 carry a transversely extending bar 26.

A comb consisting of a large number of teeth 27 is secured to the bar 26 with the teeth pointing obliquely downwards towards the surface of the upper side of the belt conveyor and to the surface of the cardboard sheet 8 when carried on the belt conveyor. These teeth 27 are adjustably and replaceably mounted on the bar 26 by suitable clamping bars 28 and bolts 29. The teeth 27 are intended to penetrate into the plaster mash situated on the cardboard sheet 8 and thereby press against the glass fibre sheet supplied over the guide plate 11, so that this glass fibre sheet penetrates into the plaster mash and is completely covered by it. The angle of inclination of the teeth 27 is adjustable, and the edge of the teeth coming into contact with the glass fibre sheet can be formed to a suitable streamlined shape.

The plate 16 with its upturned lateral edges 17 is fixed by lateral straps 30 to the machine and serves to support and shape the cardboard sheet. As can be seen from Fig. 1 and 2, the lateral edges 31 of the cardboard sheet 8 are bent upwards as the sheet enters the channel-section plate 16. Plaster mash supplied from the device 6 through discharge tube 7 thus falls into a mould formed by the cardboard sheet with its upturned edges 31, as can be seen from Fig. 2.

The aforementioned small distance between the lateral walls 18 of the curved guide plate 11 and the upwardly bent edges 17 of the other guide plate 16 permits the passage therebetween of the upwardly bent cardboard edges 31 with a small clearance and also provides support thereto, so that good shaping of the plaster mash is rendered possible. The upper edge of the upturned edges 31 is referenced 32 in Fig. 1. The glass fibre sheet is referenced 33. In Fig. 2 the position of the glass fibre woven sheet 33 in the plaster of the board is shown. The upper run 2 of the belt conveyor can be seen in Fig. 2 in section on a guide or support roll 4.

The production of the building board according to this invention takes place in the following manner.

Cardboard sheet 8 is fed along the table 1, over the plate 16 which forms the upturned edges 31 and on to the upper run 2 of the conveyor 31. Woven glass fibre sheet 33 is fed through the shaping plate 11 to overlie the cardboard sheet 8. The conveyor 34 advances the cardboard sheet 8 in the direction of the arrow F and plaster mash, or more correctly semihydrate mash, is discharged through the discharge tube 7 onto the cardboard 8 rearwardly of the forming device 5. On account of the movement of the cardboard sheet 8 and its raised edges 31, the plaster mash cannot flow out sideways, but is entrained by the cardboard sheet as it moves towards the shaping plate 11. The shaping plate 11 distributes the pile of plaster mash uniformly along the "cardboard trough" by its lower edge 35 and the glass fibre sheet is applied over the uniformly distributed plaster mash core and is prewetted thereby.

The cardboard trough carrying the plaster mash and the glass fibre sheet then moves beneath the teeth 27 which press the glass fibre sheet into the still flowable, highly plastic plaster mash which penetrates the fabric and flows therethrough automatically to adopt a substantially uniform level surface. If desired, a smoothing device, e.g., a roller my be additionally provided to smooth the surface of the plaster mash after the surface has been levelled by the teeth 27.

As can be seen from Fig. 2, the width of the glass fibre sheet 33 is not quite as wide as that of the board to be produced so that the lateral edges of the fabric are well encased in plaster.

As can also be seen from Fig. 2, the upturned edges 31 of the cardboard sheet 8 project above the surface of the plaster mash. These edges are later cut off flush with the exposed surface of the board, i.e., the level of the plaster mash, after the plaster has hardened sufficiently, so that an absolutely smooth surface of the plaster, reinforced by the worked-in glass fibre fabric, is produced. This glass fibre fabric is in the form of a web or sheet and is most preferably woven with meshes having widths ranging from a few tenths of a millimetre to several centimetres. It must however be readily penetrable by the plaster mash. If a further reinforcing of the plasterboard is necessary or desired, a second device 5 similar to that previously described can be provided at such a distance after the device 5 shown in Fig. 1 that a second glass fibre sheet can be supplied over a second guide plate 11 with a second toothed comb to push it into the plaster mash. In this case, the first glass fibre sheet can be pressed

more deeply than the second sheet into the plaster mash, so that it comes to rest practically just above the cardboard 8.

The teeth 27, which press the glass fibre sheet into the plaster mash, are of a suitable non-corroding material with a polished surface, so that adhesion and solidifying of plaster is prevented or rendered as difficult as possible.

Preferably, however, the teeth 27 are in the form of small tubes which have a circular or oval cross-section and are closed at the end which penetrates into the plaster mash. This end is formed as a shoe or skate, acting as a guide surface for the glass fibre sheet. The tube itself is, however, of a porous material such as is commercially obtainable, for example, a sintered, liquid-permeable material, all the tubes being in communication with a liquid reservoir, for example a water supply. By maintaining a small pressure, a water film can be maintained on the outer face of each tubular tooth, thus preventing adhesion and solidifying of plaster mash on the outer wall of the tube, particularly at the surface of the plaster mash. The liquid pressure can be maintained by gravity by providing a vessel containing liquid and adjustable in height.

The guide plate or plates 11 may also be supplied with a water film on their outer surfaces facing the plaster mash and may be constructed in a similar manner to the teeth that is, the sheets 11 can be double-walled and be connected to a water tank.

It will be appreciated that the expression "cardboard" is used herein in the general sense and includes other paper or paper-like products commonly used to face plasterboard.

Similarly, the term "plaster" is used herein to denote a material which is initially flowable and settable in the manner of plaster used in the manufacture of plasterboard.

Claims

1. A method of making a building board using plaster and cardboard, characterised in that, from a continuously supplied cardboard sheet, a trough is formed by bending the edges upwards to form upstanding edge portions, and into this trough plastic plaster mash is introduced, is formed to the desired thickness and at least one glass fibre sheet permeable to the plaster mash is continuously supplied to its free plaster surface and is pressed into the plaster mash in such e way that the glass fibre sheet is completely covered with the plaster mash, and the upstanding edge portions of the cardboard sheet are cut off in the plane of the surface of the plaster.

2. A method according to Claim 1 characterised in that two glass fibre woven sheets are pressed successively and to differing depths into the plaster mash.

3. A method of making a building board using plaster and cardboard which comprises continuously feeding cardboard sheet material along a predetermined path from a feed roll of such material, bending the edges of the cardboard sheet material upwards during its advance along said path to form upstanding edges, depositing plaster mash on the cardboard sheet material as it is advanced along said path, spreading and levelling the deposited plaster mash between said upstanding edges, continuously feeding a glass fibre sheet permeable to the plaster mash from a feed roll thereof over the spread and levelled plaster mash and pushing the glass fibre sheet into and below the level of the plaster mash and trimming the upstanding edges to the level of the plaster mash.

4. A method of making a building board substantially as herein described with reference to the accompanying drawings.

5. Apparatus for carrying out the method of any one of the preceding claims comprising means for continuously feeding a cardboard sheet material along a predetermined path, means associated with said path and operable to bend the edges of the cardboard sheet material upwards during its advance along said path to form upstanding edges, means for depositing plaster on the cardboard sheet materiel as it is advanced along said path, means for spreading and levelling the deposited plaster mash between said upturned edges, means for continuously feeding a glass fibre sheet permeable to the plaster mash over the spread and levelled plaster mash, means operable to push the glass fibre sheet into and below the level of the plaster mash and means for trimming the upstanding edges to the level of the plaster mash.

6. Apparatus according to Claim 5 in which the means for continuously feeding the cardboard sheet material along a predetermined path comprises a conveyor belt arranged as a continuation of a table.

7. Apparatus according to Claim 6 in which the means operable to bend the edges of the cardboard sheet materiel comprises a plate of U-section through which the cardboard sheet material is advanced.

8. Apparatus according to Claim 7 in which levelling and spreading means comprises a curved guide plate adjustable in height relative to the feed path and mounted on the plate of U-section.

9. Apparatus according to Claim 8 in which the pushing means for the glass fibre sheet includes a toothed comb disposed after the levelling and spreading means considered in the direction of feed, mounted to extend transversely of the direction of feed and adjustable in height relative to the feed path.

10. Apparatus according to Claim 9 in which the curved guide plate is fixed to a rod extending transversely of the feed path and is adjustable in height relative to the feed path and is capable of being locked by threaded spindles disposed at its end and journalled in lateral brackets of the U-shaped guide plate.

11. Apparatus according to Claim 10 in which angle members are fixed to the transverse rod and carry at their ends a further rod which is furnished

with arms pointing in the direction of advance of the feed path and to which pivotal arms are fixed carrying the toothed comb.

12. Apparatus according to Claims 9, 10 or 11 in which the toothed comb comprises a bar carrying adjustable teeth capable of being locked in pairs on the bar.

13. Apparatus according to Claim 12 in which the teeth are fixed on clamps displaceable and capable of being fixed by screws on the bar.

14. Apparatus according to Claim 12 or 13 characterised in that the teeth are of a non-corroding material and have a highly polished surface.

15. Apparatus according to Claim 12 or 13 in which the teeth are in the form of slender tubes and that their end penetrating into the plaster mash is formed as a shoe or skate and that the wall of the tube constituting the tooth is of a porous material permeable to liquid.

16. Apparatus according to Claim 15 in which all the teeth are connected through suitable pipes and hoses to a liquid storage vessel, the liquid level of which is adjustable relative to the height of the teeth.

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